

WHAT IS CLAIMED IS:

1 1. A memory system, comprising,
2 a memory bus;
3 a plurality of memory modules coupled to the memory bus, each memory
4 module including:
5 a memory array organized for access into a plurality of memory lines;
6 a code array for storing error codes, including a distinct error code for
7 each of the plurality of memory lines;
8 access logic for accessing memory lines in the memory array,
9 receiving from the error logic the error detection signal, and initiating a remedial
10 action when the error detection signal indicates that a specified memory line is not
11 consistent with the corresponding error code in the code array;
12 error logic, coupled to the memory array and code array, for
13 determining whether any specified memory line in the memory array is not
14 consistent with the corresponding error code in the code array and generating a
15 corresponding error detection signal; and
16 a scheduler, coupled to the access logic, for initiating reading of the
17 memory lines in the memory array in accordance with a memory scrubbing
18 schedule;
19 wherein each said memory module in the plurality of memory modules
20 concurrently performs memory scrubbing in accordance with the memory scrubbing
21 schedule.

1 2. The memory system of claim 1, wherein
2 the scheduler of each memory module in said plurality of memory modules is
3 configured to ensure a scrubbing of at least single bit errors in the memory lines of
4 the memory array during each successive occurrence of a predefined memory
5 scrubbing time period.

1 3. The memory system of claim 1, wherein

2 the error logic includes error correction logic for correcting at least a single bit
3 error in the specified memory line when the specified memory line is not consistent
4 with the corresponding error code in the code array; and
5 each memory module is configured to remove at least single bit errors in the
6 memory lines of the memory array during each successive occurrence of a
7 predefined memory scrubbing time period.

1 4. A memory system, comprising,
2 a memory bus;
3 a plurality of memory modules coupled to the memory bus, each memory
4 module including:
5 a memory array organized for access into a plurality of memory lines of
6 predefined size, each memory line having a plurality of distinct portions;
7 a code array for storing error codes, including a distinct error code set
8 for each of the plurality of memory lines, each error code set including a plurality of
9 error codes with a distinct error code for each of the plurality of distinct portions of
10 the associated memory line;
11 access logic for accessing memory lines in the memory array,
12 receiving from the error logic the error detection signal, and initiating a remedial
13 action when the error detection signal indicates that any portion of a specified
14 memory line is not consistent with the corresponding error code in the code array;
15 error logic, coupled to the memory array and code array, for
16 determining whether any of the portions of a specified memory line in the memory
17 array is not consistent with the corresponding error code in the code array and
18 generating a corresponding error detection signal; and
19 a scheduler, coupled to the access logic, for initiating reading of the
20 memory lines in the memory array in accordance with a memory scrubbing
21 schedule;
22 wherein each said memory module in the plurality of memory modules
23 concurrently performs memory scrubbing in accordance with the memory scrubbing
24 schedule.

- 1 5. The memory system of claim 4, wherein
2 the scheduler of each memory module in said plurality of memory modules is
3 configured to ensure a scrubbing of at least single bit errors in the memory lines of
4 the memory array during each successive occurrence of a predefined memory
5 scrubbing time period.
- 1 6. The memory system of claim 4, wherein
2 the error logic includes error correction logic for correcting at least a single bit
3 error in the specified memory line when any portion of the specified memory line is
4 not consistent with the corresponding error code in the code array; and
5 each memory module is configured to remove at least single bit errors in the
6 memory lines of the memory array during each successive occurrence of a
7 predefined memory scrubbing time period.
- 1 7. A memory module, comprising,
2 a memory array organized for access into a plurality of memory lines of
3 predefined size, each memory line having a plurality of distinct portions;
4 a code array for storing error codes, including a distinct error code set for
5 each of the plurality of memory lines, each error code set including a plurality of
6 error codes with a distinct error code for each of the plurality of distinct portions of
7 the associated memory line;
8 access logic for accessing memory lines in the memory array, receiving from
9 the error logic the error detection signal, and initiating a remedial action when the
10 error detection signal indicates that any portion of a specified memory line is not
11 consistent with the corresponding error code in the code array;
12 error logic, coupled to the memory array and code array, for determining
13 whether any of the portions of a specified memory line in the memory array is not
14 consistent with the corresponding error code in the code array and generating a
15 corresponding error detection signal; and
16 a scheduler, coupled to the access logic, for initiating reading of the memory
17 lines in the memory array in accordance with a memory scrubbing schedule.

1 8. The memory module of claim 7, wherein
2 the scheduler of said memory module is configured to ensure a scrubbing of
3 at least single bit errors in the memory lines of the memory array during each
4 successive occurrence of a predefined memory scrubbing time period.

1 9. The memory module of claim 7, wherein
2 the error logic includes error correction logic for correcting at least a single bit
3 error in the specified memory line when any portion of the specified memory line is
4 not consistent with the corresponding error code in the code array; and
5 the memory module is configured to remove at least single bit errors in the
6 memory lines of the memory array during each successive occurrence of a
7 predefined memory scrubbing time period.

1 10. A method of memory scrubbing in a plurality of memory modules coupled to a
2 memory bus, each memory module including a plurality of memory lines organized
3 into a memory array so that each memory line is accessible, for each memory
4 module, the method comprising:
5 maintaining a code array that includes a distinct error code for each of the
6 plurality of memory lines in the memory array associated with the memory module;
7 generating an error detection signal that corresponds to a specified memory
8 line in the memory array when any portion of the specified memory line is not
9 consistent with the corresponding error code in the code array;
10 initiating the reading of the memory lines in the memory array associated with
11 the module in accordance with a memory scrubbing schedule; and
12 initiating a remedial action when the error detection signal indicates that the
13 specified memory line is not consistent with the corresponding error code in the
14 code array;
15 wherein each said memory module in the plurality of memory modules
16 concurrently performs memory scrubbing in accordance with the memory scrubbing
17 schedule.

1 11. The method of claim 10 wherein the memory scrubbing ensures that at least
2 single bit errors in the memory lines of the memory array are scrubbed during each
3 successive occurrence of a predefined memory scrubbing time period.

1 12. The method of claim 10, wherein said generating step further including the
2 step of correcting at least a single bit error in the specified memory line when any
3 portion of the specified memory line is not consistent with the corresponding error
4 code in the code array; and

5 each memory module in the plurality of memory modules is configured to
6 remove at least single bit errors in the memory lines of the memory array during
7 each successive occurrence of a predefined memory scrubbing time period.

8 13. A method of memory scrubbing in a plurality of memory modules coupled to a
9 memory bus, each memory module including a plurality of memory lines of
10 predefined size, each memory line having a plurality of distinct portions, the plurality
11 of memory lines organized into a memory array so that each memory line is
12 accessible, for each memory module, the method comprising:

13 maintaining a code array that includes a distinct error code set for each of the
14 plurality of memory lines in the memory array associated with the memory module,
15 each error code set including a plurality of error codes with a distinct error code for
16 each of the plurality of distinct portions of the associated memory line;

17 generating an error detection signal that corresponds to a specified memory
18 line in the memory array when any of the portions of the specified memory line is not
19 consistent with the corresponding error code in the code array;

20 initiating the reading of the memory lines in the memory array associated with
21 the module in accordance with a memory scrubbing schedule; and

22 initiating a remedial action when the error detection signal indicates that any
23 portion of the specified memory line is not consistent with the corresponding error
24 code in the code array;

25 wherein each said memory module in the plurality of memory modules
26 concurrently performs memory scrubbing in accordance with the memory scrubbing
27 schedule.

1 14. The method of claim 13, wherein the memory scrubbing ensures that at least
2 single bit errors in the memory lines of the memory array are scrubbed during each
3 successive occurrence of a predefined memory scrubbing time period.

1 15. The memory system of claim 13, the generating step further including the
2 step of correcting at least a single bit error in the specified memory line when any
3 portion of the specified memory line is not consistent with the corresponding error
4 code in the code array; and

5 each memory module in the plurality of memory modules is configured to
6 remove at least single bit errors in the memory lines of the memory array during
7 each successive occurrence of a predefined memory scrubbing time period.

1 16. A method of memory scrubbing in a memory module, the memory module
2 including a plurality of memory lines of predefined size, each memory line having a
3 plurality of distinct portions, the plurality of memory lines organized into a memory
4 array so that each memory line is accessible, the method comprising:

5 maintaining a code array that includes a distinct error code set for each of the
6 plurality of memory lines, each error code set including a plurality of error codes with
7 a distinct error code for each of the plurality of distinct portions of the associated
8 memory line;

9 generating an error detection signal that corresponds to a specified memory
10 line in the memory array when any of the portions of the specified memory line is not
11 consistent with the corresponding error code in the code array;

12 initiating the reading to the memory lines in the memory array associated with
13 the module in accordance with a memory scrubbing schedule; and

14 initiating remedial action when the error detection signal indicates that any
15 portion of the specified memory line is not consistent with the corresponding error
16 code in the code array.

1 17. The method claim 16, wherein the memory scrubbing ensures that at least
2 single bit errors in the memory lines of the memory array are scrubbed during each
3 successive occurrence of a predefined memory scrubbing time period.

1 18. The method of claim 16, wherein the generating step further includes the step
2 of correcting at least a single bit error in the specified memory line when any portion
3 of the specified memory line is not consistent with the corresponding error code in
4 the code array; and

5 the memory module is configured to remove at least single bit errors in the
6 memory lines of the memory array during each successive occurrence of a
7 predefined memory scrubbing time period.

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